What is claimed is:

- 1. An apparatus for combinatorial chemistry on a
- 2 substrate comprising:
- 3 a manifold having one or more outlets positioned to
- 4 deliver one or more chemicals to the substrate; and
- 5 a linear drive for moving the substrate below the
- 6 manifold.
- 1 2. The apparatus of claim 1, wherein the manifold is
- 2 defined further as comprising one or more outlets that form
- 3 linear delivery spray heads.
- 1 3. The apparatus of claim 1, wherein the manifold
- 2 delivers one or more chemicals for nucleic acid synthesis to
- 3 the substrate.
- 1 4. The apparatus of claim 1, wherein the manifold
- 2 delivers one or more chemicals for peptide synthesis.
- 1 5. The apparatus of claim 1, wherein the manifold
- 2 delivers one or more chemicals for nucleic acid synthesis.
- 1 6. The apparatus of claim 1, wherein the manifold
- 2 delivers one or more chemicals for oligomer synthesis.
- The apparatus of claim 1, wherein the manifold is
- 2 further defined as one or more manifolds comprising:
- 3 an acetonitrile manifold;
- 4 an oxidizer manifold;
- 5 a capping reagent manifold;
- one or more monomer manifolds; and
- 7 a deblock manifold.

- 1 8. The apparatus of claim 1, further comprising a mask
- 2 containing one or more holes positioned between the manifold
- 3 and the substrate.
- 1 9. The apparatus of claim 1, wherein the substrate
- 2 comprises a chemically nonreactive material.
- 1 10. The apparatus of claim 1, wherein the substrate
- 2 comprises Delrin.
- 1 11. The apparatus of claim 1, wherein the substrate
- 2 comprises Polyethylene.
- 1 12. The apparatus of claim 1, wherein the substrate
- 2 comprises Fiberglass.
- 1 13. The apparatus of claim 1, wherein the substrate
- 2 comprises Glass Micro-fiber filter (GMFF).
- 1 14. The apparatus of claim 1, wherein the substrate
- 2 comprises a material coated with a chemically non-reactive
- 3 coating.
- 1 15. The apparatus of claim 1, wherein the substrate
- 2 comprises a top surface and wherein the top surface is
- 3 slanted.
- 1 16. The apparatus of claim 1, wherein the substrate
- 2 comprises one or more wells.
- 1 17. The apparatus of claim 1, wherein the substrate
- 2 comprises a multi-well plate.
- 1 18. The apparatus of claim 1, wherein the substrate
- 2 comprises a multi-well filter plate.
- 1 19. The apparatus of claim 16, wherein the one or more
- 2 wells of the plate further comprise a slanted interior edge.

- 1 20. The apparatus of claim 16, wherein the plate is
- 2 further define as a multi-well filter plate and comprises:
- 3 a top and a bottom plate containing one or more wells;
- 4 and
- 5 a semi-permeable membrane positioned between the top and
- 6 bottom plates.
- 1 21. The apparatus of claim 16, wherein the wells
- 2 comprise a slanted cross-section.
- 1 22. The apparatus of claim 16, wherein the wells
- 2 comprise a slanted cross-section and a frit.
- 1 23. The apparatus of claim 16, wherein the wells
- 2 comprise first and second slanted portions.
- 1 24. The apparatus of claim 16, wherein the wells
- 2 comprise first and second slanted portion, and wherein at
- 3 least one frit is fixed within the first or second slanted
- 4 portion of the well.
- 1 25. The apparatus as in claim 16, wherein each of the
- 2 one or more wells further comprise a synthesis substrate.
- 1 26. The apparatus of claim 1, further comprising a
- 2 computer connected to and controlling the linear drive.
- 1 27. The apparatus of claim 1, further comprising one or
- 2 more chemical reservoirs in fluid communication with one or
- 3 more manifolds.
- 1 28. The apparatus of claim 1, further comprising a
- 2 computer connected to and controlling one or more valves that
- 3 control the flow of fluid between the one or more chemical
- 4 reservoirs with the one or more manifolds.
- 1 29. The apparatus of claim 1, further comprising:

- 2 one or more chemical reservoirs in fluid communication
- 3 with the one or more manifolds; and
- 4 one or more valves control the flow of fluid from the
- 5 chemical reservoirs to the one or more manifolds.
- 1 30. The apparatus of claim 1, further comprising a mask
- 2 positioned between the manifold and the substrate.
- 1 31. The apparatus of claim 30, wherein the mask
- 2 positioned between the manifold and the substrate is layered
- 3 on the substrate.
- 1 32. The apparatus of claim 30, wherein a mask is
- 2 positioned further comprises one or more through-holes
- 3 generally over one or more reaction sites of the substrate.
- 1 33. The apparatus of claim 30, wherein the mask
- 2 comprises Teflon™.
- 1 34. The apparatus of claim 30, wherein the mask
- 2 comprises Teflon™ between 0.002 and 0.25 inches thick.
- 1 35. The apparatus of claim 30, wherein the mask
- 2 comprises polyethylene.
- 1 36. The apparatus of claim 30, wherein the mask
- 2 comprises fiberglass.
- 1 37. The apparatus of claim 30, wherein the mask
- 2 comprises Delrin.
- 1 38. The apparatus of claim 30, wherein the mask
- 2 comprises polypropylene.
- 1 39. The apparatus of claim 30, wherein the mask
- 2 comprises single-sided Teflon $^{\text{TM}}$ tape.

- 1 40. The apparatus of claim 30, wherein the mask
- 2 comprises molded polypropylene and further comprising divots
- 3 that generally match one or more wells of a substrate.
- 1 41. The apparatus of claim 30, wherein the mask
- 2 comprises molded polyethylene and further comprising divots
- 3 that generally match one or more wells of a substrate.
- 1 42. The apparatus of claim 30, wherein the mask
- 2 comprises a magnetically attractive material.
- 1 43. The apparatus of claim 30, wherein the mask
- 2 comprises an electrostatic charge opposite an electrostatic
- 3 charge on the substrate.
- 1 44. The apparatus of claim 1, further comprising a
- 2 vacuum in communication with the substrate.
- 1 45. The apparatus as in claim 1, wherein the substrate
- 2 comprises one or more reactive group protected from a chemical
- 3 reaction by one or more removable protecting groups.
- 1 46. The apparatus of claim 45, wherein the one or more
 - removable protecting groups is removed by addition of a
- 3 deblocking reagent.
- 1 47. The apparatus of claim 45, wherein the substrate
- 2 comprises one or more monomers for nucleic acid synthesis.
- 1 48. The apparatus of claim 45, wherein the substrate
- 2 comprises one or more monomers for peptide synthesis.
- 1 49. The apparatus of claim 45, wherein the substrate
- 2 comprises one or more monomers for peptide nucleic acid
- 3 synthesis.
- 1 50. The apparatus of claim 45, wherein the substrate
- 2 comprises one or more monomers for carbohydrate synthesis.

- 1 51. The apparatus of claim 45, wherein the substrate
- 2 further comprises a linker.
- 1 52. The apparatus of claim 45, wherein the substrate
- 2 comprises a small molecule library.
- 1 53. The apparatus of claim 1, wherein the substrate
- 2 comprises 6, 12, 48, 96, 384, 864, 1,536 or more reaction
- 3 sites.
- 1 54. The apparatus of claim 1, wherein the substrate is
- 2 rectangular.
- 1 55. The apparatus as in claim 1, wherein substrate
- 2 comprises one or more wells, and the one or more wells are
- 3 canted.
- 1 56. An apparatus for combinatorial chemistry comprising:
- 2 a substrate comprising one or more reaction sites;
- 3 a mask positioned on the substrate;
- 4 a one or more manifolds positioned to deliver one or more
- 5 chemicals to at least a portion of the substrate; and
- a linear drive for moving the substrate and the mask
- 7 below the one or more linear manifolds.
- 1 57. An apparatus for combinatorial chemistry comprising:
- 2 a substrate comprising one or more reaction sites;
- 3 a mask comprising one or more through holes positioned
- 4 generally over the one or more reaction sites of the
- 5 substrate;
- a one or more linear manifolds positioned to deliver one
- 7 or more chemicals to the substrate;

- 8 a linear drive for moving the substrate and the mask
- 9 below the one or more linear manifolds; and
- 10 a vacuum below the one or more reaction sites of the
- 11 substrate.
 - 1 58. An apparatus for synthesizing oligomers comprising:
- 2 a substrate comprising one or more reaction sites;
- 3 a mask comprising one or more through holes positioned
- 4 generally over the one or more reaction sites of the
- 5 substrate;

Shore the state of the state of

ji itr

Arrest de la constante de la c

- one or more linear manifolds positioned to deliver one or more chemicals to the substrate comprising:
- 8 an acetonitrile manifold;
- 9 an oxidizer manifold;
- 10 a capping reagent manifold;
- one or more monomer manifold; and
- 12 a deblock manifold;
- a linear motion table that moves the substrate and the
 - 14 mask below the one or more manifolds; and
 - a vacuum below the one or more reaction sites of the
 - 16 substrate.
 - 1 59. A method for controlling a chemical reaction in one
 - 2 or more reaction sites protected by a mask comprising the
 - 3 steps of:
 - 4 positioning a mask comprising one or more wells over a
 - 5 substrate comprising one or more reaction sites;

- 6 flooding a deblock reagent over the surface of the mask, 7 wherein the deblock reagent will only enter unmasked reaction 8 sites; 9 removing the mask; 10 flooding a mix of activator and one reactive monomer into 11 all reaction sites; 12 flooding a mix of cap A and B reagents into all reaction 13 sites; 14 flooding and oxidizing reagent into all reaction sites; 15 and 16 repeating the above steps for the other reactive 17 1 2 3 3 monomers. 60. A method for controlling a chemical reaction in one or more reaction sites protected by a mask comprising the steps of: 4 (a) flooding a deblock reagent into all the reaction sites of a substrate; 6 (b) positioning a monomer-specific mask for a specific 7 monomer over a substrate; 8 (c) flood a specific monomer and activator over the
 - 9 substrate, wherein only those reaction sites with open holes
 - 10 in the mask will receive one or more specific monomers;
 - 11 (d) removing the mask; and
 - 12 (e) repeating steps (b) through (d) for each specific
 - 13 monomer;

il il nair

- 14 (f) flooding a mix of cap A and B reagents into all
- 15 reaction sites; and

- 16 (g) flooding an oxidizing reagent into all reaction
- 17 sites.
- 1 61. A mask for chemical synthesis comprising:
- 2 a non-reactive sheet having a top and a bottom surface;
- 3 one or more through-holes that form an array that
- 4 generally match the position of one or more wells of a
- 5 substrate.
- 1 62. The mask of claim 61, wherein the substrate
- 2 comprises a multi-well plate.
- 1 63. The mask of claim 61, wherein the substrate
- 2 comprises a multi-well filter plate.
- 1 64. The mask of claim 61, wherein the mask comprises a
- 2 substantially chemically non-reactive material.
- 1 65. The mask of claim 61, wherein the mask comprises a
- 2 Teflon™-coated polymer.
- 1 66. The mask of claim 61, wherein the mask comprises
- 2 polyethylene.
- 1 67. The mask of claim 61, wherein the mask comprises
- 2 fiberglass.
- 1 68. The mask of claim 61, wherein the mask comprises
- 2 Delrin.
- 1 69. The mask of claim 61, wherein the mask comprises
- 2 polypropylene.
- 1 70. The mask of claim 61, wherein the through-holes are
- 2 further defined as having one or more nozzles on the bottom
- 3 surface.

- 1 71. The mask of claim 70, wherein the through-holes are
- 2 further defined as having one or more nozzles on the bottom
- 3 surface, wherein the nozzles have an angle that matches the
- 4 angle of the wells in the multi-well plate.
- 1 72. The mask of claim 70, wherein the through-holes are
- 2 further defined as having one or more nozzles on the bottom
- 3 surface, wherein the nozzles have an angle that is more than
- 4 the angle of the wells in the multi-well plate.
- 1 73. The mask of claim 70, wherein the through-holes are
- 2 further defined as having one or more nozzles on the bottom
- 3 surface, wherein the nozzles have an angle that is less than
- 4 the angle of the wells in the multi-well plate.
- 1 74. A method of determining synthetic order of monomer
- 2 addition comprising the steps of:
- 3 determining the synthesis order for the addition of a
- 4 specific monomer;
- 5 deciding whether a mask is to be positioned on a
- 6 substrate;
- 7 moving the substrate to a preselected position for
- 8 chemical addition;
- 9 adding a specific monomer;
- 10 washing the substrate; and
- 11 repeating the above steps if another monomer is to be
- 12 added.

1 1 75. The method of claim 74, wherein the step of catalyzing the addition of a monomer is defined further as 2 3 comprising the steps of: 4 performing a deblock step; 5 putting on a mask to protect sites in which a monomer 6 will not be added; 7 delivering one or more monomers; 8 performing a capping steps and performing an oxidizer 9 step. 76. A method for producing polymers comprising the steps 1 2 of: placing a reactive compound on one or more reaction sites of a substrate; 5 protecting one or more reaction sites of a substrate with a mask; and

7 controlling a chemical reaction in the one or more 8 reaction sites not protected by the mask.

77. The method of claim 76, wherein the step of controlling a reaction is defined further as not deblocking the reactive compound .

- 1 78. The method of claim 76, wherein the step of
- 2 controlling a chemical reaction comprises the steps of:
- 3 flooding a deblocking reagent over the surface of the
- 4 mask;
- flooding a coupling reagent over the surface of the mask,
- 6 wherein the coupling reagent comprises one or more reactive
- 7 compounds;
- 8 flooding a capping reagent over the surface of the mask;
- 9 and
- 10 flooding oxidizing reagent over the surface of the mask.
- 1 79. The method of claim 76, wherein the one or more
- 2 reactive compounds are defined further as phosphoramidite
- 3 comprising compounds.
- 1 80. The method of claim 76, wherein phosphoramidite
- 2 comprising compounds include one or more protected
- 3 phosphoramidite nucleic acid bases A, G, C, T, U or
- 4 derivatives thereof.
- 1 81. The method of claim 76, wherein chemical reaction is
- 2 the addition of one or more monomers for carbohydrate
- 3 synthesis.
- 1 82. The method of claim 76, wherein chemical reaction is
- 2 the addition of one or more monomers for nucleic acid
- 3 synthesis.
- 1 83. The method of claim 76, wherein chemical reaction is
- 2 the addition of one or more monomers for peptide synthesis.

- 1 84. The method of claim 76, wherein the capping agent
- 2 further comprises a cap A and a cap B reagent and wherein they
- 3 acetylate unreacted termini.
- 1 85. A method of determining the mask pattern for monomer
- 2 addition comprising the steps of:
- 3 reading the sequence of one or more monomer sequences;
- 4 setting up an array that contains all the possible
- 5 permutations of the monomers wherein each of these
- 6 permutations having a first and a second element, wherein the
- 7 first element records the number of cycles required to
- 8 complete synthesis and the second element records the number
- 9 of monomers to be deblocked;
- 10 selecting a variable number that equals the total number
- 11 of required monomers types;
- selecting a second variable that contains the total
- 13 number of wells; and
- testing the array for the minimum number of masks that
 - 15 are required to complete all the monomer additions; and
 - selecting the array that contains the minimum number of
 - 17 masks.
 - 1 86. The method of claim 85, further comprising the step
 - 2 of pre-determining areas with sequences in common within the
 - 3 sequences of the one of more monomers and preparing masks for
 - 4 those areas of with sequences in common independent from the
 - 5 determination of the array.